Environmental–Structural Interventions to Reduce HIV/STI Risk Among Female Sex Workers in the Dominican Republic

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Objectives. We assessed the effectiveness of 2 environmental–structural interventions in reducing risks of HIV and sexually transmitted infections (STIs) among female sex workers in the Dominican Republic.

Methods. Two intervention models were implemented over a 1-year period: community solidarity in Santo Domingo and solidarity combined with government policy in Puerto Plata. Both were evaluated via preintervention–postintervention cross-sectional behavioral surveys, STI testing and participant observations, and serial cross-sectional STI screenings.

Results. Significant increases in condom use with new clients (75.3%–93.8%; odds ratio [OR] = 4.21; 95% confidence interval [CI] = 1.55, 11.43) were documented in Santo Domingo. In Puerto Plata, significant increases in condom use with regular partners (13.0%–28.8%; OR = 2.97; 95% CI = 1.33, 6.66) and reductions in STI prevalence (28.8%–16.3%; OR = 0.50; 95% CI = 0.32, 0.78) were documented, as were significant increases in sex workers' verbal rejections of unsafe sex (50.0%–79.4%; OR = 3.86; 95% CI = 1.96, 7.58) and participating sex establishments' ability to achieve the goal of no STIs in routine monthly screenings of sex workers (OR = 1.17; 95% CI = 1.12, 1.22).

Conclusions. Interventions that combine community solidarity and government policy show positive initial effects on HIV and STI risk reduction among female sex workers. (*Am J Public Health.* 2006;96:120–125. doi:10.2105/AJPH.2004.042200)

Efforts to reduce female sex workers' vulnerability to HIV have frequently relied on individual-level interventions such as condom promotion and management of sexually transmitted infections (STIs).[1–4] Increasingly, HIV prevention programmers are focusing their attention on "environmental–structural" interventions that seek to alter the physical and social environments in which individual behavior takes place.[5,6] Two environmental–structural approaches have emerged in the context of female sex work—community mobilization initiatives such as the "Sonagachi project" in Calcutta, India,[7–9] and government policy initiatives such as the Thai "100% condom program"[10,11]—and program evaluations of each have documented increases in condom use and decreases in STI prevalence. Several countries have sought to adopt or adapt either the community mobilization[12–14] or government policy approach[15–18] to prevent HIV and STIs among sex workers and their partners; however, few have sought to integrate the strengths of both approaches.

In 1995, 2 Dominican nongovernmental organizations (NGOs), *Centro de Orientación e Investigación Integral* (COIN), based in Santo Domingo, and *Centro de Promoción y Solidaridad Humana* (CEPROSH), based in Puerto Plata, began exploring the possibility of adapting elements of the Thai 100% condom program to the Dominican context, where peer education among sex workers began in the late 1980s.[19] Both qualitative and quantitative research was conducted in Santo Domingo from 1996 to 1998 to help inform the process of adapting elements of the Thai model to the Dominican context.[20,21] On the basis of the results of these studies, and through consultations with the local sex worker organization, Movimiento de Mujeres Unidas (MODEMU), 2 environmental–structural intervention models were developed. Our primary objective was to assess the effectiveness of each of these models in reducing HIV and STI risks among female sex workers.

METHODS

Study Design

We primarily relied on a pretest–posttest design to evaluate the interventions over a period of 1 year. The intervention was implemented in 68 female sex establishments (34 per city) in 2 cities: Santo Domingo, the capital, and Puerto Plata, the fifth largest city, located in the northeastern section of the country. We also accessed serial cross-sectional data from government health clinics to complement the preintervention–postintervention data. Within each city, the geographic areas where commercial sex was most prevalent were purposively selected. Selection criteria for participating sex establishments were based on the potential acceptability and feasibility of implementing the intervention research and included establishments employing more than 5 women and those where a set fee was paid by the client to the establishment. The managers of all 68 sex establishments selected agreed to participate in the intervention activities.

Intervention Components

Over the course of the study, an average of 15 sex workers worked in each of the participating sex establishments, and all sex workers were invited and encouraged to participate in all of the intervention components implemented in their city. Components 1–4, discussed next, were implemented in both cities, while component 5 was implemented in Puerto Plata only. The reason we chose to implement component 5 in Puerto Plata was that the political leadership necessary to

implement a policy-level intervention was present in that city at the time of the study.

1. Solidarity and collective commitment. Quarterly workshops and monthly follow-up meetings were implemented with sex workers, establishment owners and managers, and other establishment employees. The purpose of these encounters was to encourage and strengthen a sense of solidarity and collective commitment toward HIV and STI prevention, and discussion included the role that each actor could play in supporting sex workers to use condoms with their partners. Population-specific educational materials were used to reinforce responsibilities and benefits pertinent to each group. An additional focus of the workshops and materials was the role of trust and intimacy associated with condom use among sex workers and regular-paying and nonpaying partners.

2. Environmental cues. Establishment owners were asked to post 100% condom posters and stickers, as well as to make available glass bowls filled with condoms. They were also asked to maintain a stock of at least 100 condoms at all times. Additional cues implemented on a quarterly basis in each establishment included disc jockey messages regarding safe sex, information booths, educational materials, and interactive theater presentations engaging male clients in HIV prevention themes, facilitated by sex worker peer educators and NGO staff.

3. Clinical services. At the time the intervention began, female sex workers in the Dominican Republic were required by the Ministry of Health to attend monthly STI checks at government clinics, and government health inspectors were mandated to monitor their attendance. This system was not implemented in a standardized or consistent manner. Our intervention sought to overcome these barriers by providing clinicians and inspectors in both cities with training in the areas of basic HIV/AIDS information, data collection and monitoring, and ethical procedures. In addition, sex worker peer educators from the project were given private offices in government clinics to provide pretest–posttest STI counseling.

4. Monitoring and encouraging adherence. In both cities, establishment owners were notified of their status in terms of adherence to 5 study elements on a monthly basis: presence of posters, visible condoms, stocks of at least 100 condoms, attendance of sex workers at monthly STI checks, and lack of positive STI diagnoses among the establishment's sex workers. These elements were evaluated each month by government health inspectors accompanied by NGO staff. No individual STI results were shared with establishment owners. At the end of each month, establishments that were not in adherence with these elements were the focus of intensified educational efforts. On a quarterly basis, award certificates were given to establishments adhering to all elements.

5. Policy and regulation. In Puerto Plata, information on a regional government policy requiring condom use between sex workers and clients was communicated to all participating sex establishment owners in a meeting that took place at the beginning of the study and was jointly sponsored by the regional health department and the implementing NGO. Owners were told that they, not the sex workers, would be responsible for ensuring that their establishment complied with the policy and associated program activities. NGO staff and regional public health officials in Puerto Plata met with establishment owners on a quarterly basis to encourage adherence to the policy and discuss barriers to implementation.

In addition to intensified educational efforts, establishments that were not in adherence in Puerto Plata were subject to a graduated sanction system targeted to establishment owners, including notifications, fines, and closings. During the course of the intervention in Puerto Plata, 113 notifications, 18 fines, and 1 temporary closing were levied on participating sex establishments as a result of nonadherence to the 5 monitoring elements assessed on a monthly basis.

Data Collection Procedures

Evaluation data were collected at baseline, between September and December 1999, and again toward the end of the 12-month intervention period, during November and December 2000. At both preintervention and postintervention, structured behavioral surveys were administered and nonroutine STI testing conducted among cross-sectional samples of approximately 200 female sex workers older than 18 years working in participating sex establishments in each city. An average of 6 sex workers from each of these establishments participated in the survey and underwent nonroutine STI testing at preintervention and postintervention. There was minimal overlap (less than 5%) of the cross-sections of sex workers recruited at preintervention and postintervention within each city.

All potential survey and nonroutine STI testing participants were recruited from government health clinics. On days selected for recruitment, our NGO study team approached every third woman from a participating establishment attending the monthly clinical consultations. All potential participants were given detailed information about the objectives, procedures, and risks and benefits of the study. Those who agreed to participate provided written consent to be interviewed and undergo nonroutine STI screening. The consent rate was 95%. Consenting participants were asked to provide urine samples for gonorrhea and chlamydia testing and vaginal swabs for trichomoniasis testing. All STI testing was confidential, and all participants testing positive for STI were treated promptly. All survey interviews were anonymous and were conducted by trained interviewers recruited from local health NGOs. Participants received approximately US$3 for completing the survey and undergoing nonroutine STI screenings.

Preintervention and postintervention participant observations were also conducted among a random sample of sex workers recruited from participating sex establishments in each city. Approximately 2 observations were conducted at each of the 34 establishments in each city at both preintervention and postintervention, with a minimum of 64 observations per city and data collection period. After selecting a woman according to established criteria, NGO staff followed a strict research protocol whereby they talked with the participant for approximately 30 minutes and then asked whether she would be willing to have sex without a condom, providing up to 4 reasons why a condom should not be used. After the sex worker gave her final response, the NGO staff member excused himself from the interaction and paid the bill for his table, compensating the sex worker with a tip of approximately US$6 for her time. All interactions were anonymous and took place within the confines of the sex establishments. After leaving the establishment, NGO staff documented the interaction in a private setting.

The local MODEMU sex worker organization was consulted on and approved of the use of the participant–observation methodology. We suggest that other researchers interested in adopting this methodology refer to the *International Ethical Guidelines for Biomedical Research Involving Human Subjects*[22] and consult with a bioethicist, as we did, to ensure that the ethical rights of the human participants involved are duly protected.

Measures

Condom use was assessed via participants' self-reports of the percentage of sex acts in which condoms were used in the past month with new clients, regular partners, and all partners. New clients were defined as people with whom sex workers had engaged in sex only once or twice in exchange for money. Regular partners were defined as people with whom they had engaged in sex at least 3 times or people they considered "trusted" partners, whether they directly paid for sex or not. These categories were developed on the basis of previous qualitative research.[20] In the case of new clients and regular partners, a 5-point Likert scale (1=*always*, 5=*never*) was used to measure condom use. Participants were also asked the total number of partners with whom they had had sex in the past month and the number of those partners with whom they had always used condoms during that time. All condom use variables were dichotomized into consistent versus inconsistent use.

Rejection of unsafe sex was measured through participant observations of female sex workers conducted by NGO staff. Four common reasons mentioned by a male client in order not to use condoms were selected on the basis of findings from previous qualitative studies: not wanting to use a condom simply because he does not like condoms, not needing to use a condom because he is a "serious guy who is married and has kids," offering 50% more money than the sex worker's asking rate, and offering 100% more money than the sex worker's asking rate. These 4 scenarios were posed sequentially to the sex worker, who was not offered the next scenario unless she rejected unsafe sex in response to all previous scenarios. The NGO worker recorded whether the sex worker accepted any of these offers or whether she verbally rejected unsafe sex throughout the encounter.

We documented *STIs* by measuring the prevalence of each of 3 infections—gonorrhea, chlamydia, and trichomoniasis—among individual sex workers also completing the preintervention and postintervention cross-sectional behavioral surveys. We constructed a dichotomized measure of whether participants had any of these 3 STIs. Chlamydia and gonorrhea were detected via Ligase chain reaction DNA tests, while the presence of trichomoniasis was established through culture-based tests.

In addition, we documented the number of establishments that achieved the goal of no STIs in a given month, per city, over the 1-year intervention. This establishment-level information was collected from local public health clinics that serve female sex workers; these clinics provide routine monthly checks using the syndromic management approach for detection of STIs.[23] We also calculated 2-month averages of the percentage of establishments with no STIs per month and city over the year.

We measured *exposure* to the intervention using a 13-item scale (Cronbach $\alpha=0.80$) that included items focusing on sex workers' exposure to key intervention components, such as solidarity and collective commitment, environmental cues, monitoring, and policy and regulation, in the past month. The scale was dichotomized at the median into high (more than 11 positive responses out of a possible total of 13) versus low. In addition, an observed measure of *adherence* to 4 intervention elements—presence of 100% condom posters, visible condoms in glass bowls, stocks of at least 100 condoms, and attendance of all sex workers at monthly STI checks—was calculated for each establishment over the course of the intervention. The 4-point adherence score was dichotomized at the median into high (3–4) versus low (0–2).

Data Analysis

Chi-square tests of association were conducted to identify differences in sociodemographic characteristics of the participants from preintervention to postintervention. Preintervention to postintervention changes in HIV- and STI-related outcomes such as condom use and STI prevalence were assessed via multivariate logistic regression analyses controlling for the 5 demographic variables for which significant differences were observed in either of the 2 cities over the course of the study (Table 1). Changes in sex workers' rejection of unsafe sex did not allow for adjusted analyses, because no sociodemographic information was collected from participating sex workers during these observations. Using serial cross-sectional data, we conducted bivariate logistic regression analyses to assess preintervention to postintervention changes, both within and across cities, in adherence to the intervention and the ability of establishments to achieve the goal of no STIs. Our serial cross-sectional data were collected at the level of the clinic and the sex establishment, and hence no sociodemographic data were available to use as controls in these analyses.

Multivariate logistic regression analyses were conducted among sex workers participating in the posttest survey to assess the relationship between exposure and adherence to the intervention and consistent condom use with all sex partners in the past month and prevalence of STIs; only variables found to be significant in the bivariate analyses were included in these multivariate analyses. Standard errors from all of the regression analyses were adjusted for potential clustering, or nonindependence of study outcomes, among women from the same sex establishment via the Huber–White robust variance estimator.[24] Regression analyses were limited to cases involving no missing data.

The original sample size calculation was based on our ability to detect significant (i.e., odds ratio [OR] of 2.0) preintervention to postintervention changes in participating establishments' adherence to the intervention, including establishment-level decreases in STI prevalence observed in routine monthly screenings across cities, with 80% power and 95% confidence. Calculating our power to test preintervention–postintervention changes in individual-level HIV- and STI-related outcomes among our feasibility-based samples, we found that we had approximately 80% power to detect an odds ratio of 2.5 or greater with 95% confidence in the case of within-city analyses.

RESULTS

Characteristics of the Sample

The majority of the female sex workers participating in the study were younger than 26 years (Table 1). Most did not have any secondary school education (i.e., more than 8 years of

TABLE 1—Sociodemographic and Behavioral Characteristics of Female Sex Workers, Preintervention and Postintervention, by Site: Dominican Republic, 1999–2000

	Santo Domingo			Puerto Plata		
	Preintervention (n = 210), %	Postintervention (n = 206), %	*P*	Preintervention (n = 200), %	Postintervention (n = 200), %	*P*
Age, y			.916			.607
18–25	60.8	61.3		54.0	56.6	
≥26	39.2	38.7		46.0	43.4	
Education, y			.167			.008
0–8	69.0	62.6		73.0	83.9	
≥9	31.0	37.4		27.0	16.1	
Civil status			.006			.562
Single	72.1	59.0		71.5	68.8	
Married	27.9	41.0		28.5	31.2	
Regular partner			.104			.004
Yes	68.6	75.7		64.0	77.3	
No	31.4	24.3		36.0	22.7	
No. of client dates in past week			.880			.022
<2	56.5	55.7		44.7	33.5	
≥2	43.5	44.3		55.3	66.5	
Total no. of sexual partners in past month			.0001			.040
<3	75.1	48.8		50.3	40.0	
≥3	24.9	51.2		49.7	60.0	
Average fee per client date, US $			.685		67.8	.423
0–18	57.1	59.1		71.5		
≥19	42.9	40.9		28.5	32.2	

schooling). While most participants reported being single in terms of their civil status, nearly two thirds, from both cities and at both preintervention and postintervention, reported having a regular sexual partner. Median numbers of dates with paying clients in the past week were relatively low, 1.0 in Santo Domingo and 2.0 in Puerto Plata at baseline. Participants from both cities charged a median average amount per client date of US$18 at baseline. Sample sociodemographic characteristics that differed significantly from preintervention to postintervention included civil status and number of sexual partners in the past month in Santo Domingo and education level, reports of a regular partner, and number of sexual partners in the past month in Puerto Plata.

Changes in HIV/STI Risk

Consistent condom use. As can be seen in Table 2, reported consistent condom use with new clients in the past month increased significantly in preintervention to postintervention adjusted analyses in Santo Domingo, from 75.3% to 93.8% (OR=4.21; 95% confidence interval [CI]=1.55, 11.43). The rate of consistent condom use with new clients was already quite high in Puerto Plata at the start of the study, at 96.5%, and the rate increased to 98.6% at postintervention (OR=2.27; 95% CI=0.47, 10.84). In the case of regular paying and nonpaying partners, the rate of consistent condom use rose significantly in Puerto Plata only, from 13.0% to 28.8% (OR=2.97; 95% CI=1.33, 6.66).

Rejection of unsafe sex. Sex workers' observed verbal rejection of unsafe commercial sex increased significantly from preintervention to postintervention in Puerto Plata only. The percentage of sex workers who rejected unsafe sex after hearing all 4 reasons offered increased from 50.0% to 79.4% (OR=3.86; 95% CI=1.96, 7.58).

STIs. In adjusted preintervention–postintervention analyses, significant decreases in the percentage of women with 1 or more STIs (gonorrhea, trichomoniasis, or chlamydia) were documented in Puerto Plata only (28.8% to 16.3%; OR=0.50; 95% CI=0.32, 0.78). STI prevalence decreased from 25.5% to 15.9% in Santo Domingo from preintervention to postintervention, but this decrease was not significant in adjusted analyses (OR=0.60; 95% CI=0.35, 1.03).

Table 3 shows the percentages of participating establishments per city that achieved the goal of no STIs among sex workers at 2-month intervals during the 1-year intervention period. We found significant increases in the ability of sex establishments to achieve this goal from preintervention to postintervention in Puerto Plata only (OR=1.17; 95% CI=1.12, 1.22). Examining the interaction between city and time, we found that there was a significant city-specific difference (greater in Puerto Plata) in the odds of establishments achieving the goal of no STIs at preintervention versus postintervention (OR=1.20; 95% CI=1.09, 1.31).

Intervention effects on condom use and STI outcomes. Multivariate logistic regression analyses controlling for adherence to the intervention, city, civil status, and presence of a regular partner showed that participants who reported a high level of exposure to the intervention were significantly more likely than participants without such exposure to use condoms consistently with all sex partners in the past month (OR=1.90; 95% CI=1.12, 3.21). Participants working in establishments with higher adherence to the intervention were not significantly more likely to have used condoms with all sex partners in the past month after control for exposure to the intervention, city, civil status, and presence of a regular partner. Only observed adherence to the intervention was significantly associated with STI prevalence among postintervention participants in the bivariate analyses, and in turn it remained the only variable in the final regression model (OR=0.52; 95% CI=0.35, 0.78).

Individual reports of exposure to the intervention increased from preintervention to postintervention in both cities (both *P*s=.000), while establishment-level adherence to the intervention increased in Puerto Plata only (OR=1.14; 95% CI=1.07, 1.21). Examining the interaction between city and time, we found that there was a significant city-specific difference in the odds of establishment

TABLE 2—Changes in Condom Use Behaviors and Sexually Transmitted Infections Among Female Sex Workers, Preintervention and Postintervention, by Site: Dominican Republic, 1999–2000

	Santo Domingo			Puerto Plata		
	Preintervention, %	Postintervention, %	Adjusted OR (95% CI)	Preintervention, %	Postintervention, %	Adjusted OR (95% CI)
Reported condom use per partner type						
New clients	75.3	93.8	4.21** (1.55, 11.43)	96.5	98.6	2.27 (0.47, 10.84)
Regular partners	14.6	17.6	1.29 (0.62, 2.70)	13.0	28.8	2.97** (1.33, 6.66)
Verbal ability to reject unsafe sex[a]						
Stated he did not like condoms	76.1	78.5	1.17 (0.57, 2.39)	79.7	94.1	4.08* (1.32, 12.60)
Stated he was a "serious guy"	71.6	76.9	1.35 (0.71, 2.58)	64.1	91.2	5.80*** (2.03, 16.57)
Offered 50% more money	67.2	73.8	1.42 (0.75, 2.64)	54.7	83.8	4.29*** (1.97, 9.35)
Offered 100% more money	64.2	72.3	1.49 (0.81, 2.73)	50.0	79.4	3.86*** (1.96, 7.58)
STI prevalence						
Gonorrhea	2.3	1.9	0.63 (0.17, 2.38)	6.6	3.9	0.59 (0.24, 1.46)
Trichomoniasis	9.1	6.1	0.58 (0.24, 1.38)	9.6	3.9	0.36** (0.17, 0.75)
Chlamydia	16.4	9.3	0.63 (0.34, 1.15)	14.6	9.8	0.70 (0.38, 1.28)
1 or more of 3 STIs	25.5	15.9	0.60 (0.35, 1.03)	28.8	16.3	0.50** (0.32, 0.78)

Note. OR = odds ratio; CI = confidence interval; STI = sexually transmitted infection. Sample sizes varied owing to missing data. Adjusted ORs controlled for significant variables shown in Table 1: education, civil status, regular partner, number of client dates, and number of sexual partners.
[a]Cumulative percentage at each level.
*P < .05; **P < .01; ***P < .001.

TABLE 3—Percentages of Participating Establishments Achieving the Goal of No Sexually Transmitted Infections During the 1-Year Intervention Period: Dominican Republic, 1999–2000 (n = 68)

	Establishments With No STIs at Preintervention, %	Average of Months 1 and 2, % (Range)	Average of Months 3 and 4, % (Range)	Average of Months 5 and 6, % (Range)	Average of Months 7 and 8, % (Range)	Average of Months 9 and 10, % (Range)	Average of Months 11 and 12, % (Range)
Santo Domingo	6	47 (44–50)	29 (. . .)	25 (20–30)	6 (4–8)	21 (. . .)	29 (23–35)
Puerto Plata	25	46 (9–83)	8 (3–13)	75 (62–87)	55 (31–79)	69 (67–71)	65 (45–86)

adherence (greater in Puerto Plata) at preintervention versus postintervention (OR= 1.20; 95% CI=1.11, 1.30).

DISCUSSION

The majority of significant preintervention to postintervention changes in key study outcomes were documented in Puerto Plata, where an intervention model that combined the strengths of community solidarity and government policy was implemented. The only significant preintervention to postintervention changes documented in Santo Domingo involved condom use with new clients. In contrast, condom use rates in Puerto Plata increased significantly with regular paying as well as nonpaying partners. While the median number of client dates per week was found to be relatively low, our data indicate that the most common types of client in the present context were regular paying partners. Hence, the increase in condom use with regular partners documented in Puerto Plata takes on additional importance. Many programs have cited lower condom use rates among sex workers and their regular paying and nonpaying partners as a key HIV prevention challenge,[25–28] suggesting the global relevance of the changes observed in this study.

In addition to reported behavioral risk indicators such as condom use, our study also documented, in Puerto Plata but not in Santo Domingo, preintervention to postintervention changes in participants' observed verbal rejection of unsafe sex and STI outcomes. Here it is important to emphasize the scope of the changes that occurred. The preintervention to postintervention decline in individual-level STI prevalence in Puerto Plata was almost 43% (from 28.8% to 16.3%). While a similar trend was found in Santo Domingo, only in Puerto Plata did decreases in STI prevalence remain significant in multivariate analyses.

It is also important to highlight that the only significant predictor of STI prevalence at postintervention was establishment-level adherence to the intervention and that adherence increased significantly over the course of the intervention in Puerto Plata only. While adherence was significantly associated with STI prevalence at postintervention, it was not significantly related to consistent condom use with all types of partners in the past month after control for exposure to the intervention. This finding suggests the need for further research regarding the potential pathways by which the significant declines in individual-level STI outcomes documented in Puerto Plata were achieved.

Our study was originally powered to test the difference in preintervention to postintervention changes across cities for establishment-level STI outcomes only. Hence, we can definitively state that participating sex establishments in Puerto Plata were significantly more effective in achieving the goal of no STIs from preintervention to postintervention. In the case of our other study outcomes, we are able to document only within-city preintervention to postintervention effects. In addition, because of our study design, we cannot establish causality regarding exposure and adherence to the intervention and changes in individual-level study outcomes. However, it is noteworthy that the broad-based, significant changes that occurred in Puerto Plata were not paralleled in Santo Domingo, which indicates that an integrated approach mobilizing both communities and governments to confront HIV- and STI-related vulnerability in the context of female sex work merits further study and application. ■

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This article was accepted July 8, 2005.

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D. Kerrigan, L. Moreno, S. Rosario, B. Gomez, H. Jerez, E. Weiss, and M. Sweat worked together to conceptualize and design the study. L. Moreno, S. Rosario, B. Gomez, and H. Jerez oversaw the implementation of the intervention research. D. Kerrigan, C. Barrington, and M. Sweat analyzed the data collected, and all authors assisted in interpreting the data.

Acknowledgments

The research was supported by the Horizons Program of the Population Council under funding from the US Agency for International Development (USAID) (contract HRNA00970001200). Additional support was received from the AcciónSIDA Project of the Academy for Educational Development and the Fogarty International Center of the National Institutes of Health through a grant to Johns Hopkins University (2D43TW000010-18-AITRP). Finally, Deanna Kerrigan was supported by a Career Development Award (K01MH3491) from the National Institute of Mental Health during the analysis and write-up phase of the research.

We would like to thank all of the intervention and research participants and the entire staff of the Centro de Orientación e Investigación Integral (COIN) in Santo Domingo and the Centro de Promoción y Solidaridad Humana (CEPROSH) in Puerto Plata for their time, dedication, and insight during the entire study process. We would also like to thank Martha Butler de Lister, director of the National STD and AIDS Control Program at the time the study began, for her help in making this research a reality, as well as Jonathan Ellen of the Johns Hopkins School of Medicine for his input and suggestions during the analysis.

Note. Any opinions expressed are those of the authors and do not necessarily reflect the views of USAID.

Human Participant Protection

The research and informed consent protocols for this study were reviewed and approved by the institutional review boards of the Johns Hopkins Bloomberg School of Public Health and the Population Council.

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